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COLLABORATIVE WORKS AND AUTHORS CONTRIBUTION OF MADURAI KAMARARAJ UNIVERSITY, TAMILNADU, INDIA - A BIBLIOMETRIC STUDY

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Abstract

Madurai Kamaraj University is one of the State University of Tamilnadu. To find scientific productivity of this institution, the data was downloaded from Web of Knowledge from 2010 to 2019. The data were analysed by Bibexcel and Excel format. For ten years 2312 publications by 3513 authors. Pajek software tool is used to create the network map. Collaborative Index, Degree of Collaboration, Collaborative Co-efficient and implement Lotka's Law were done.

Keywords: *Madurai Kamaraj University, Collaborative Co-efficient, Bibliometric Analysis, Collaborative Index, Authorship Pattern,Bibexcel, Pajek.*

Introduction:

Madurai Kamaraj University was established in 1966 as one of the State University. This University is having 20 Schools and 77 Department. "To Seek Truth is Knowledge" is the Motto. To make young entrepreneurs and professionals up to global level is one of the vision. They are concentrating in teaching, research in innovative method. They are concentrating in social development of rural also. The data were downloaded in the Web of Knowledge, Madurai Kamaraj University in the search box and select the Address field for Web of Science Core Collections. The data downloaded in plain text format.

Need for the Study:

Madurai Kamaraj University's authors are more intelligent. To show their knowledge they are doing research in Collaborative manner. Sujit Bhattacharya and Shilpa found data of nanotechnology in Web of Science for ten years from 2000 to 2009. They find the highly productivity journals, number of production and impact factor. The nanotechnology linkage of prolific institutions, keywords analysis in world and india's output. They discuss regarding authorship pattern and highly cited papers. They done analysis in pajek network mapping.[1] Suresh kumar evaluate authors productivity of artificial neural network research. From 1991

to 2014, the data got from Web of Science of 3411 articles by 5654 authors. The Lotka's Law was implemented. The authors in the top ranked are contributed continuously. Most of them done collaborative with other scientist or countries. This collaborative work is very productive one.[2]Manthiramoorthi M done bibliometric analysis regarding research output of information literacy research output. He analysis with Lotka's Inverse Power Law Model, find authorship pattern, doubling time. The data was downloaded in Web of Science from 2008 to 2017.[3]ShubhadaNagarkar and Manisha Kengar analysis physics research work of Savitribai Phule Pune University, India from 1990 to 2014. The main purpose of the paper is to year – wise productivity, types of publications, collaborations and authorship pattern. The faculty done National and International Collaborations. They preferred to publish their papers in USA publications journals, and its impact factor from 1.124 to 3.736. From 2010 the collaborative authors publications increased. [5]

Limitations and Methodology:

Data was downloaded from Web of Science, the world wide accepted as highly intellectual productive database. In the search box "Madurai Kamaraj University" select "Address" field. We fix the year range from 2010 to 2019 and result is 2312. The data were downloaded in plain text format and analysis with Bibexcel and Excel. For creating Network map Pajek too was used.

Objectives:

- To find out Highly Productive Authors, Collaborated Author and number of Works
- To create Author Collaborate Network for more than 16 research output.
- To find the Authorship Pattern with Year – Wise
- Find Collaborative Index of Maduarai Kamaraj University
- Apply Subramanyam's formula of Degree of Collaboration
- Apply Collaborative Co-efficient of Madurai Kamaraj University
- Apply Lotka's Law for Madurai Kamaraj University Publications

Highly Productive Authors:

From 2010 to 2019 Madurai Kamaraj University publish research contribution in Web of Science is 2312. The total number of authors is 3513. This below table – 1 show the top 30 authors name and number of work from 2010 to 2019. Muthusubramanian S with 105 results as First Place, 92 publication of Gunasekaran P second and Pitchumani K as 91 results in third place. For that purpose Bibexcel was used, in the old tag "Au" was given. As a result .doc, .out file was got. With "Whole field Intact" and select "descending Order" the .out file was selected. The result we can get .mul and .mut file. By that we can find highly productive authors.

Table-1 Highly Productive Authors

S.No	Author	Record
1.	Muthusubramanian S	105
2.	Gunasekaran P	92
3.	Pitchumani K	91
4.	Kumar GG	82
5.	Perumal S	81
6.	Dhakshinamoorthy A	70
7.	Ramaraj R	66
8.	Rajendhran J	66
9.	Rajagopal S	61
10.	Ramakrishnan V	58
11.	Rajan M	58
12.	Kumar RR	53
13.	Ramachandran K	50
14.	Anitha K	49
15.	Sethuraman K	49
16.	Siva A	46
17.	Varalakshmi P	44
18.	Ashokkumar B	44
19.	Saraswathi R	44
20.	Chen SM	42
21.	Garcia H	39
22.	Bhuvanesh N	38
23.	Vasantha VS	38
24.	Kumar RS	38
25.	Mayandi J	34
26.	Kumaraguru AK	33
27.	Iyakutti K	33
28.	Sivaraman G	32
29.	Natarajan S	32
30.	Padmini V	32

Collaborated Authors of Madurai Kamaraj University:

The research productivity from 2010 to 2019 of Madurai Kamaraj University is 2312. Totally Three Thousand Five Hundred and Thirteen authors output 313 authors done collaborative work. This below table – 2 shows the top Nineteen author, collaborate author and number of works done is shown.

Table -2 Collaborate Author and Number of Records

S.No	Author	Collaborate Author	Records
1.	Gunasekaran P	Rajendhran J	54
2.	Dhakshinamoorthy A	Garcia H	37
3.	Ashokkumar B	Varalakshmi P	35
4.	Bhuvanesh N	Muthusubramanian S	31
5.	Kumar GG	Yoo DJ	29
6.	Kim AR	Kumar GG	28
7.	Munusamy MA	Rajan M	28
8.	Ramamurthi K	Sethuraman K	28
9.	Kim AR	Yoo DJ	25
10.	Menendez JC	Perumal S	20
11.	Rajarajan M	Suganthi A	20
12.	Almansour AI	Kumar RS	20
13.	Pandikumar A	Ramaraj R	20
14.	Kumar GG	Nahm KS	19
15.	Nagarajan S	Ponnuswamy A	19
16.	Rajagopal S	Velayudham M	19
17.	Mareeswaran PM	Rajagopal S	19
18.	Sriram D	Yogeeswari P	19
19.	Lu KL	Rajagopal S	19

Out of 3513 authors, the highest production of 16 and above authors selected for creating network. On the basis of 2312 results vector file was find out. The network and

vector file was called from Pajek. The size of ball is big, when the individual publications are very high. The arrow shows the number of collaborations. The image is very beautiful.

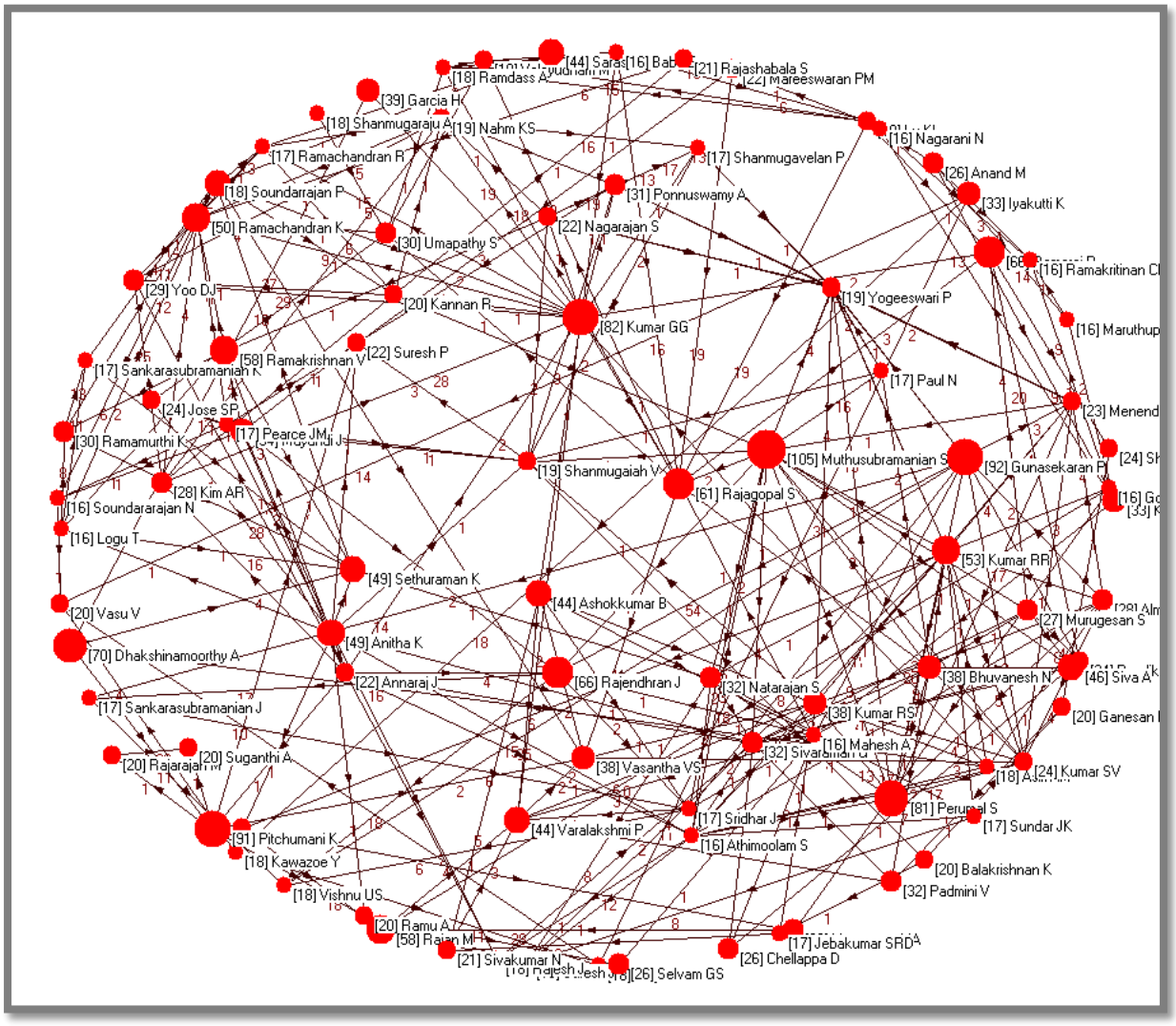

Figure – 1 Collaborate Author Network

Authorship Pattern and Year - Wise Distribution:

Madurai Kamaraj University scientist done collaborative work. Single research is only 0.74%. Four authors work is high percentage (22.02%) with 19.85% three authors contributions in Second place. In 2013 no single author contribution, three authors done more research. But in 2019, Forty Nine authors done one research. It is very appreciable one.

Table-3 Authorship Pattern and Year -Wise Distribution

Year	Single	Two	Three	Four	Five	Six	Seven	Eight	Nine	Ten	More than 10	Total
2010	1	26	28	23	26	15	3	3	2		3	130
2011	2	41	38	45	48	13	10	5		4	1	207
2012	1	28	57	43	30	18	12	2	1		6	198
2013		43	52	41	35	19	7	3	3	1	1	205
2014	1	39	53	55	49	21	15	6	3	1	4	247
2015	3	33	53	62	60	26	16	6	3	5	2	269
2016	2	34	51	53	48	30	12	8	6	2	6	252
2017	2	43	46	64	46	28	19	9	4	3	9	273
2018	3	33	43	63	42	33	25	13	7	2	10	274
2019	2	28	38	60	42	41	22	9	4	5	6	257
Total	**17**	**348**	**459**	**509**	**426**	**244**	**141**	**64**	**33**	**23**	**48**	**2312**
%	**0.74**	**15.05**	**19.85**	**22.02**	**18.43**	**10.55**	**6.10**	**2.77**	**1.43**	**0.99**	**2.08**	**100.00**

Collaborative Index of Madurai Kamaraj University:

Neelamma G and Gavisiddappa Anandhalli find authorship pattern in the Crystallography from 1989 to 2013. They had done Collaborative index, Degree of Collaboration, Collaborative Co-efficient and apply Lotka's Inverse Square Law. They analysed the data in Excel and SPSS.[4]Collaborative index (CI) This is one of the early measures of degree of collaboration derived by Lawani (1986).

$$\sum_{f}^{A} = \frac{1\ fi/N}{N}$$

It is a measure of mean number of authors. Although it is easily computable, it is not easily interpretable as a degree, for it has no upper limit moreover; it gives a non-zero weight to single-authored papers, which involve no collaboration.

Calculation of Collaborative Index

$$C\,I = \frac{(f1)1 + (f2)2 + (f3)3 + L + (fk)\,k}{N}$$

Where, f1, f2,f3……= number of authors

N = Number of publications in that year

By this formula this below table shows the Collaborative Index (CI) for the year 2010 is 4.19. This study shows from 2010 to 2019. There is a decrease in the year 2013 (3.98) after that there is gradual increase. The average Collaborative Index is 4.44 from 2010 to 2019.

Table-4 Collaborative Index of Madurai Kamaraj University from 2010 to 2019

Year	Single	Two	Three	Four	Five	Six	Seven	Eight	Nine	Ten	> 10	Collaboration	Total	CI
2010	1	26	28	23	26	15	3	3	2		3	545	130	4.19
2011	2	41	38	45	48	13	10	5		4	1	857	207	4.14
2012	1	28	57	43	30	18	12	2	1		6	833	198	4.21
2013		43	52	41	35	19	7	3	3	1	1	816	205	3.98
2014	1	39	53	55	49	21	15	6	3	1	4	1063	247	4.30
2015	3	33	53	62	60	26	16	6	3	5	2	1191	269	4.43
2016	2	34	51	53	48	30	12	8	6	2	6	1143	252	4.54
2017	2	43	46	64	46	28	19	9	4	3	9	1250	273	4.58
2018	3	33	43	63	42	33	25	13	7	2	10	1330	274	4.85
2019	2	28	38	60	42	41	22	9	4	5	6	1246	257	4.85
Total	**17**	**348**	**459**	**509**	**426**	**244**	**141**	**64**	**33**	**23**	**48**	**10274**	**2312**	**4.44**

Degree of Collaboration

The Degree of Collaboration of authors by year wise is shown in Table 5. The extent of Degree of Collaboration in Anthropometric measurements research has been measured with the help of the formula devised by K. Subramaniam.
Subramanyam's formula has been adopted to examine the extent of research collaboration in the study.

The formula is **C = Nm / Nm + Ns**

Where

C = Degree of Collaboration in a discipline
Nm = Number of multiple authored papers
Ns = Number of single authored papers

Accordingly, the Degree of Collaboration has been calculated for the year 2010 is as follows:

$$C = \frac{129}{129+1} = \frac{129}{130} = 0.992$$

The Degree of Collaboration for any subject ranges from 0.01 to 0.99 and it is always below 1. But in the year 2013 there is no single author research, the Degree of Collaboration is 1. The average Degree of Collaboration is 0.993.

Table-5 Degrees of Collaboration

Year	Single Author	Multiple Authors	Total No of Publication	Percentage of Multiple Authors	Degree of Collaboration
2010	1	129	130	99.23	0.992
2011	2	205	207	99.03	0.990
2012	1	197	198	99.49	0.995
2013		205	205	100.00	1.000
2014	1	246	247	99.60	0.996
2015	3	266	269	98.88	0.989
2016	2	250	252	99.21	0.992
2017	2	271	273	99.27	0.993
2018	3	271	274	98.91	0.989
2019	2	255	257	99.22	0.992
Total	**17**	**2295**	**2312**	**99.26**	**0.993**

Collaborative Co-efficient of Madurai Kamaraj University:

The publication of single, the individual author received one credit. Then, by two authors received 1/2 . On the basis "n" authors gets 1/n. So average credit goes to each author of a random publications is E [1/n], the value may be between 0 and 1.

$$CC = \frac{1-E}{N} = 1 - \left[\frac{1}{j}\right] p\ (N = j)$$

And its same $\sum$ rate is

$$\text{Collaborative Co-efficient} = \frac{1 - [\, f1 + (1/2)\, f2 + (1/3) / f3 + \ldots.. + (1/k)\, fk}{N}$$

This below table 6 shows the Collaborative Co – efficient for the year.

fj = the number of j-authors research publications published in a discipline during a certain period of time.

N = the total number of research papers published in a discipline during a certain period of time:

k = the greatest number of authors per paper in a discipline.

There is a opinion that the Collaborative Co-efficient incorporates the sum of the merits of both collective index and degree of collaboration. It lies between 0 and 1.Tends to zero as single authored publications dominate and differentiates among levels of multiple authorship.

$$= 1 - \left[\frac{f1 + (1/2)\, f2 + (1/3)\, f3 + \ldots + (1/k)\, fk}{N} \right]$$

On the basis of above calculation, the Collaborative Co-efficient for the year 2010 is 0.29.

Table-6 Collaborative Co-efficient (CC) of Maduarai Kamaraj University

Year	Single	Two	Three	Four	Five	Six	Seven	Eight	Nine	Ten	> 10	Total		CC
2010	1	26	28	23	26	15	3	3	2		3	130	38.08	**0.29**
2011	2	41	38	45	48	13	10	5		4	1	207	60.73	**0.29**
2012	1	28	57	43	30	18	12	2	1		6	198	56.37	**0.28**
2013		43	52	41	35	19	7	3	3	1	1	205	61.15	**0.30**
2014	1	39	53	55	49	21	15	6	3	1	4	247	68.91	**0.28**
2015	3	33	53	62	60	26	16	6	3	5	2	269	73.05	**0.27**
2016	2	34	51	53	48	30	12	8	6	2	6	252	67.98	**0.27**
2017	2	43	46	64	46	28	19	9	4	3	9	273	74.10	**0.27**
2018	3	33	43	63	42	33	25	13	7	2	10	274	70.57	**0.26**
2019	2	28	38	60	42	41	22	9	4	5	6	257	64.66	**0.25**
Total	**17**	**348**	**459**	**509**	**426**	**244**	**141**	**64**	**33**	**23**	**48**	**2312**	**635.59**	**0.27**

Lotka's Law for Madurai Kamaraj University Publications:

Statistical Analysis is done in Bibliometric work. In 1926 Alfred J. Lotka was tested the frequency distribution of scientific productivity from chemical abstracts (1907-1916)[6]. Lotka's concluded that the number of authors making n contribution is about 1/n2 of those making one and the proportion of all contributors. D value of Madurai Kamaraj University is 2.303

Table-7 Distribution of Author Productivity as Lotka's Law

No. Records	Authors	X	Y	X ^{2X2}	XY	yx/ Syxyx /Syx	Syx/ SyxSyx/ Syx	$1/x^{n1/xn}$	$f=c(1/x^n)$/ $f=c(1/x^n)$	f_{efe}	D
17	1	1.230	0.000	1.514	0.000	0.017	0.017	0.056	0.006	0.006	0.023
348	2	2.542	0.301	6.460	0.765	0.348	0.365	0.003	0.000	0.006	0.371
459	3	2.662	0.477	7.085	1.270	0.459	0.824	0.002	0.000	0.007	0.831
509	4	2.707	0.602	7.326	1.630	0.509	1.333	0.002	0.000	0.007	1.340
426	5	2.629	0.699	6.914	1.838	0.426	1.759	0.002	0.000	0.007	1.766
244	6	2.387	0.778	5.700	1.858	0.244	2.003	0.004	0.000	0.007	2.010
141	7	2.149	0.845	4.619	1.816	0.141	2.144	0.006	0.001	0.008	2.152
64	8	1.806	0.903	3.262	1.631	0.064	2.208	0.014	0.002	0.010	2.218
33	9	1.519	0.954	2.306	1.449	0.033	2.241	0.028	0.003	0.013	2.254
23	10	1.362	1.000	1.854	1.362	0.023	2.264	0.041	0.005	0.018	2.282
13	11	1.114	1.041	1.241	1.160	0.013	2.277	0.073	0.008	0.026	**2.303**
8	12	0.903	1.079	0.816	0.975	0.008	2.285	0.120	0.014	0.040	2.325
5	13	0.699	1.114	0.489	0.779	0.005	2.29	0.194	0.022	0.062	2.352
5	14	0.699	1.146	0.489	0.801	0.005	2.295	0.194	0.022	0.084	2.379
1	15	0.000	1.176	0.000	0.000	0.001	2.296	1.000	0.114	0.198	2.494
5	16	0.699	1.204	0.489	0.842	0.005	2.301	0.194	0.022	0.220	2.521
1	17	0.000	1.230	0.000	0.000	0.001	2.302	1.000	0.114	0.334	2.636
3	18	0.477	1.255	0.228	0.599	0.003	2.305	0.326	0.037	0.371	2.676
2	19	0.301	1.279	0.091	0.385	0.002	2.307	0.493	0.056	0.427	2.734
1	27	0.000	1.431	0.000	0.000	0.001	2.308	1.000	0.114	0.541	2.849
1	30	0.000	1.477	0.000	0.000	0.001	2.309	1.000	0.114	0.655	2.964
1	32	0.000	1.505	0.000	0.000	0.001	2.31	1.000	0.114	0.769	3.079
1	35	0.000	1.544	0.000	0.000	0.001	2.311	1.000	0.114	0.883	3.194
1	49	0.000	1.690	0.000	0.000	0.001	2.312	1.000	0.114	0.997	3.309
2312	363	25.8851	24.7330	50.8806	19.1584	2.312	47.366	8.7506	0.9976		

Findings:

Madurai Kamaraj University research productivity, published in Web of Science was analysed with the help of Bibexcel and Excel. For ten years 2312 publications by 3513 authors. According to success leads success some authors produce more and more research. On the basis of highly published authors 16 and above network was created with help of Pajek tool. Their we can view the total number of individual publications. The arrow shows to whom they had collaborated and how many numbers. Most of the authors wants collaborate research. In 2013 there is no single author contribution. Four authors research is 22.02%. It is very good. The Collaborative Index of 2018 is 4.85, the average is 4.44. The average Degree of Collaboration is 0.993. So Multiple authors percentage is 99.26. Collaborative Co-efficient of Madurai Kamaraj University for the year 2019 is 0.25. They want share the credit to all the joint authors. The Lotka's Law also tested. On the whole Madurai Kamaraj University is doing research in Collaborative manner.

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